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Preliminary echo integration-trawl survey results for walleye pollock (*Theragra chalcogramma*) in the Shelikof Strait area, the shelf break area near Chirikof Island, and Barnabas Trough during March, 2002

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INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center conduct research surveys of Gulf of Alaska walleye pollock (*Theragra chalcogramma*) to estimate pollock distribution and abundance. Preliminary cruise results presented here are from the echo integration-trawl (EIT) survey carried out between 12 and 26 March, 2002, in the Shelikof Strait area, off the Gulf of Alaska shelf break east of Chirikof Island, and in Barnabas and Chiniak Troughs. The primary cruise objective was to assess the abundance and distribution of pollock. This report summarizes observed pollock distribution, relative abundance, size composition, sex ratio and maturity information. Biomass estimates, acoustic system calibration results, and other cruise results will be reported in a subsequent document.

METHODS

Itinerary

12 Mar Embark scientists in Dutch Harbor, AK

12-14 Mar Transit to the Shelikof Strait area

14-20 Mar EIT survey of the Shelikof Strait area
21-24 Mar EIT survey of the Gulf of Alaska shelf break east of Chirikof Island
24-25 Mar EIT survey of Barnabas Trough
25 Mar Acoustic system calibration in Ugak Bay, AK
26 Mar Transit to Kodiak; disembark scientists; end of cruise

Acoustic Equipment

Acoustic data were collected with a Simrad EK500¹ quantitative echo-sounding system on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research. Two split-beam transducers (38 kHz and 120 kHz) were mounted on the bottom of the vessel's centerboard extending 9 m below the water surface. System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics. Data from the echo sounder were logged and processed using Simrad BI500 echo integration and target strength analysis software on a SUN workstation. Results presented here are based on the 38 kHz data. Acoustic data were also collected at 38 and 120 kHz frequencies with a new acoustic system (Simrad EK60 echosounder, Sonardata Echologger, and Echoview post-processing software) to compare with the primary acoustic system. A free-drifting acoustic buoy was repeatedly deployed for several hours during the cruise to evaluate whether pollock exhibited an avoidance response to vessel noise.

Trawl Gear and Oceanographic Equipment

Two trawl nets were used to sample observed echosign. Midwater and near-bottom echosign was sampled with an Aleutian Wing 30/26 trawl (AWT). Demersal echosign was sampled with a poly nor' eastern bottom trawl with roller gear. Vertical and horizontal net opening and depth were monitored with a Wesmar third wire netsounder system or a Furuno netsounder system attached to the headrope on all hauls. Both nets were fished with 5 m² Fishbuster trawl doors (1,250 kg).

¹ Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

Physical oceanographic data collected during the cruise included temperature/depth profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope and conductivity-temperature-depth (CTD) observations collected with a Sea-Bird CTD system at the calibration site. Sea surface temperature, salinity, and other environmental data were also collected and logged using the *Miller Freeman's* Scientific Computing System (SCS). Ocean current profile data were obtained using the vessel's centerboard-mounted acoustic Doppler current profiler system operating continuously at 150 kHz in the water-profiling mode.

Survey Design

The survey of the Shelikof Strait area covered the area from near Chirikof Island to about Cape Chiniak on the Alaska Peninsula and consisted of 28 parallel transects spaced 7.5 nmi apart (Fig. 1). The survey of the shelf break area began near Chirikof Island and progressed eastward to the mouth of Barnabas Trough. The survey consisted of 19 transects spaced 6 nmi apart, except along a single transect midway through the survey where it was necessary to reorient remaining transects to maintain a perpendicular alignment to the bathymetry. The survey of Barnabas Trough began near the final shelf-break transect and ended in Ugak Bay. The transects were spaced 3 nmi apart except for the first two which were spaced at 6 nmi. A zig-zag transect pattern was used in Chiniak Trough. Echo integration and trawl data were collected 24 hours a day. Acoustic system settings were based on results from standard sphere calibrations and instrument performance during previous surveys. Trawl hauls were conducted to identify echosign and to provide biological samples. Pollock were sampled to determine sex, fork length, body weight, age, maturity, and ovary weight of selected females. Fork lengths were measured to the nearest cm. Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning.

Data Analysis

Acoustic data were collected between 14 m of the surface and 0.5 m of the bottom, except where the bottom exceeded 1000 m, the lower limit of data collection. Echosign data identified as

pollock were stored in a relational database. Trawl haul catches were examined to define geographical areas with similar length distributions.

PRELIMINARY RESULTS

Biological sampling

Biological data, including those for ancillary research projects, were collected from one bottom trawl and twenty-eight midwater trawl hauls (Table 1, Fig. 1).

Shelikof Strait area

Pollock were observed on all 28 transects. The densest echosign attributed to near-bottom pollock occurred from about 30 nmi northwest of Chirikof Island to about Cape Kekurnoi (Fig. 2). Similar to the 2001 survey but unlike most other Shelikof Strait surveys, very little echosign was detected beyond Katmai Bay along the west side of the strait, where the bulk of the mature pre-spawning pollock are usually detected. Significant quantities of juvenile pollock (mostly 3-year old fish²) formed well-defined midwater layers during the day at about 150 m depth and dispersed layers from about 50-175 m at night (Fig. 3). Most of these layers extended from slightly north of the Semidi Islands to about Middle Cape.

Nineteen trawl hauls were conducted in the Shelikof Strait area. Length data from trawl hauls 3, 7, 11, and 13 (Fig. 4, and see Fig. 1) illustrate the range of pollock sizes encountered. Trawl hauls conducted in mid-water layers contained predominantly 3-year old pollock (e.g. haul 7). The majority of pollock caught in near-bottom trawl hauls were also 3-year olds, although the contribution of 2-year old and adult pollock (e.g. haul 11) was often greater than for hauls targeting the mid-water layers. Eulachon (*Thaleichthys pacificus*) were also common in hauls targeting near-bottom echosign. Age 3-pollock did not dominate the catch in hauls 3

²Because age data are not yet available, length ranges were used as a proxy for age based on length at age from previous surveys. Pollock between 9-16 cm fork length (FL) are considered 1-year olds, most pollock between 17-23 cm FL are considered 2-year olds, most pollock from 24-30 cm FL are considered 3-year olds, and most pollock exceeding 30 cm FL are considered adults.

and 13. Haul 3, conducted on near-bottom pollock echosign east of Chirikof Island, contained nearly equal amounts of 2- and 3-year old pollock. Haul 13, which was the only bottom trawl haul conducted, contained mostly adult pollock. Few 1-year old pollock were caught anywhere in the Shelikof Strait area. The unweighted maturity composition of male pollock longer than 40 cm FL was <1% immature, 5% developing, 74% mature pre-spawning, 5% spawning, and 16% spent (Fig. 5). The unweighted maturity composition for females longer than 40 cm FL was 0% immature, 16% developing, 84% pre-spawning, 0% spawning, and <1% spent. Female pollock were estimated to be 50% mature at 42 cm (Fig. 6). The mean GSI (gonad weight/total body weight, Fig. 7) for mature pre-spawning females of 0.12 was similar to the mean GSI from the 2001 survey but lower than the mean GSIs (0.14-0.19) reported for other recent (1992-2000) Shelikof surveys, which suggests that the fish may have spawned relatively later in the Shelikof Strait area this year. One acoustic buoy deployment was conducted near Middle Cape. Hauls 17-19 were associated with this effort.

Shelf Break area

Most echosign attributed to mid-water layers of pollock was detected within the two shelf-break bights between Chirikof Island and Barnabas Trough at about 300-500 m depth, with most fish detected over bottom depths of 300-800 m, although this layer sometimes extended beyond bottom depths deeper than 1,500 m (Fig. 8). Occasionally, small amounts of near-bottom pollock echosign were observed over bottom depths as shallow as 200 m. Substantial acoustic backscattering was attributed to lanternfishes (myctophids) and other micronekton species, which occurred along the offshore portions of the transects at about 200-300 m depth. This “myctophid” scattering layer, which occurred mostly over bottom depths from 800 to deeper than 1,500 m, may have obscured very low densities of pollock.

Nine midwater trawl hauls were conducted during the shelf break survey. Adult pollock dominated the catch in 8 trawl hauls conducted on the pollock layer (e.g. Haul 20 in Fig. 4) and various micronekton species including lanternfishes, Pacific viperfish (*Chauliodus macouni*), unidentified squid and shrimp were caught in the single haul that targeted the “myctophid” layer. The size composition of adult pollock were similar to adults from the Shelikof Strait area (e.g.

haul 20 versus haul 13; Fig. 4). The unweighted maturity composition for male pollock longer than 40 cm FL was <1% immature, 1% developing, 69% mature pre-spawning, 10% spawning, and 20% spent (Fig. 9). The unweighted maturity composition for females longer than 40 cm FL was 0% immature, 2% developing, 97% pre-spawning, <1% spawning, and 1% spent. Female pollock were estimated to be 50% mature at 41 cm (Fig. 10). The mean GSI for mature pre-spawning females was 0.15 (Fig. 11).

Barnabas Trough

Virtually no pollock were detected in Barnabas Trough except in Ugak Bay (Fig. 12), where the small amount of pollock echosign consisted of either 2- or 3-year olds. A single acoustic buoy deployment was conducted in Ugak Bay.

Chiniak Trough

About 30 nmi of zig-zag tracklines were run through Chiniak Trough on March 26 while en route to Kodiak to disembark the scientific party. About 2-3 nmi of echosign was detected near Cape Chiniak. No hauls were conducted to determine the species composition of the echosign due to time constraints.

SCIENTIFIC PERSONNEL

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